Forest Insect & Disease Management

Survey Report

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DUTCH ELM DISEASE
OTTAWA NATIONAL FOREST, MICHIGAN
USING REMOTE SENSING

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INTRODUCTION

The Ottawa National Forest located in the western Upper Peninsula of Michigan, has approximately 348,000 acres of northern hardwoods within the Forest boundaries. Since Dutch elm disease (DED) had not been reported on the Ottawa National Forest but was known to be on land adjacent to the Forest boundaries, the St. Paul Field Office was requested to detect and evaluate the occurrence and impact of DED using remote sensing. Sketch mapping of 230,000 acres was included as a supplement to the photographic survey after DED was found on a ground survey outside of the photographic contract area.

OBJECTIVE

The purpose of this survey was to determine the occurrence and impact of DED on and adjacent to the Ottawa National Forest.

METHODS

Remote Sensing: During August 1975, 17,000 acres around Merriweather, Michigan, 46,000 acres in and southwest of Iron River, Michigan, 20,000 acres around Bessemer, Michigan, 16,000 acres around Marenisco, Michigan and 40,000 acres along U.S. Highway 2 running east and west through the Forest were photographed at a scale of 1:12000 using an RC-10 camera mounted in an Aero Commander. The photography was taken by Aviation Management, R-9, Milwaukee, Wisconsin. The photography was 9-inch color infrared format type. The photographed areas were plotted on a 1/4-mile-to-the-inch scale for disease area mapping. The elm mortality areas were then classified as heavy mortality (more than an average of one tree per acre) or moderate to light mortality (between 0.9 trees per acre and 0.1 tree per acre). The number of dead and dying elm trees was recorded for each disease center on each image. Fifteen disease centers from the Ottawa and 15 centers from the northern part of the Nicolet Survey were selected for ground truth comparisons. All data were adjusted using the coefficient of determination.

The tree species, diameter at breast height (d.b.h.), number of logs, tree condition and cause of condition were recorded for each tree in each groundchecked infection center.

The average volume for dead and dying elms and standard error of the mean were calculated using the volumes obtained from the ground truth comparison. The average volumes were then applied to the total number of dead and dying elms on the photographed area.

Sketch Mapping: The sketch mapping was accomplished by Bruce Anderson, Technician, St. Paul FI&DM, and Marion True, TMA, Ottawa National Forest. The Ontonagon and Sturgeon River systems were flown during July 1975 using a Cessna 172 at approximately 1,500 feet above ground with an air speed of 110 mi/h. Elm mortality was sketch mapped on a 1/4-inch-to-the-mile Forest map. Elm samples were collected by the Forest and sent to the St. Paul Field Office for culturing.

RESULTS AND DISCUSSION

The remote sensing and sketch mapping revealed that the Dutch elm disease is established in the vicinity of Merriweather, Iron River, Bessemer and Marenisco, and the Ontonagon and Sturgeon Rivers (Figure 1). The mortality around Merriweather (Figure 2) is light and scattered. Iron River (Figure 3), Bessemer (Figure 4), and Marenisco (Figure 5) all have areas of heavy mortality with an interspersion of light mortality. The sketch-mapped areas were not classified into mortality classes.

Of the 139,400 acres photographed, 180 acres were classified as heavy mortality on the Ottawa National Forest and 575 acres on other ownerships. Two hundred and fifteen acres were classified as moderate to light mortality on the Ottawa N.F. with 1,125 acres classified the same on other ownerships (Table 1).

Of the 230,000 acres sketch mapped, 500 acres contained dead elm trees on the Ottawa N.F. and 1,650 on other ownerships (Table 2).

Two thousand one hundred elm trees were dead or dying in the photographed area. Twenty-six percent of the elms were dead on the Ottawa N.F., 53 percent were dead on other ownerships, 6 percent were dying on the Ottawa N.F., with 2 percent of the elm dead or dying from causes other than DED (Table 3).

Volume analysis showed 66,360 fbm of standing dead elm on the Ottawa National Forest and 134,160 fbm of dead elm on other ownerships, plus 15,340 fbm of elm that died in 1975 on the National Forest and 31,180 fbm that died in 1975 on other ownerships.

The annual rate of mortality is expected to increase each year until the resource is reduced to 20% or more by 1995.

The acreage figures and number of dead and dying elms are summarized for each photographed or sketch-mapped area in Tables 1, 2 and 3.

MANAGEMENT CONSIDERATIONS

The following action plan is recommended to reduce the rate of Dutch elm disease spread and tree mortality.

1. Establish and keep current a map of all Dutch elm disease on the National Forest.

2. Develop elm harvest zones. (When possible, harvest during September to December to help reduce beetle populations and the rate of spread.)

    a. Establish Red zones within 1 to 2 miles* of known infection centers (20 trees or more). Initiate accelerated harvest of elm resource within this zone.

*Distance should be adjusted to coincide with management objectives.

b. Establish Yellow zones within 2 to 10 miles* of known infection centers. Initiate an accelerated harvest of valuable elm stands and conduct an inventory of the remaining elm resource.

c. Establish Blue zones within 10 to 15 miles* of known infection centers. Conduct normal sales operation. Maintain an intensive inventory of the elm resource for future harvest information.

3. Limit shipment of elm logs, with bark intact, to September-December when possible.

4. Eliminate stockpile of elm logs at mills or in the forest during May-July when possible. Debarked or chipped elm wood is safe at any time.

*Distance should be adjusted to coincide with management objectives.

Table 1. Extent and intensity of elm mortality, Ottawa N.F., by area determined by remote sensing techniques, 1975.

Area	Acres Surveyed	Acres Heavy Mortality		Acres Moderate to Light Mortality	
		*NF	**PVT	NF	PVT
Merriweather	17,000	0	0	40	100
Iron River	46,000	0	250	100	825
Bessemer	20,000	0	225	0	200
Marenisco	16,000	180	100	75	0
Total	99,000	180	575	215	1,125

*NF - National Forest
**PVT - Private and other

Table 2. Extent of elm mortality, Ottawa N.F., determined by sketch mapping techniques, 1975.

Area	Acres Surveyed	Acres Mortality *NF (Estimate)	Acres Mortality **PVT (Estimate)
Ontonagon River	225,000	500	1,500
Sturgeon River	5,000	0	150
Total	230,000	500	1,650

*NF - National Forest
**PVT - Private and other

Table 3. Number and volume of dead and dying elm by area, Ottawa N.F., 1975, determined by remote sensing.

Area	No. Dead Elm Trees		No. Dying Elm Trees		Mortality other than DED		Volume (fbm)					
							Dead Elm		Dying Elm		Total	
	NF	PVT	NF	PVT	NF	PVT	NF	PVT	NF	PVT	NF	PVT
Merriweather	54	40	13	10	1	1	6,480 ± 810	4,800 ± 600	1,690 ± 150	1,300 ± 120	8,170 ± 960	6,100 ± 720
Iron River	79	355	20	95	1	4	9,480 ± 1,180	42,600 ± 5,320	2,600 ± 240	12,350 ± 1,140	12,080 ± 1,420	54,950 ± 6,460
Bessemer	20	628	10	157	1	8	2,400 ± 300	75,360 ± 9,420	1,300 ± 120	20,410 ± 1,880	3,700 ± 420	95,770 ± 11,300
Marenisco	400	100	75	24	4	1	48,000 ± 6,000	12,000 ± 1,500	9,750 ± 900	3,120 ± 280	57,750 ± 6,900	15,120 ± 1,780
Total	553	1,123	118	286	7	14	66,360 ± 8,290	134,160 ± 16,840	15,340 ± 1,410	31,180 ± 3,420	81,700 ± 9,700	165,340 ± 20,250

Coefficient of determination r^2 0.82.

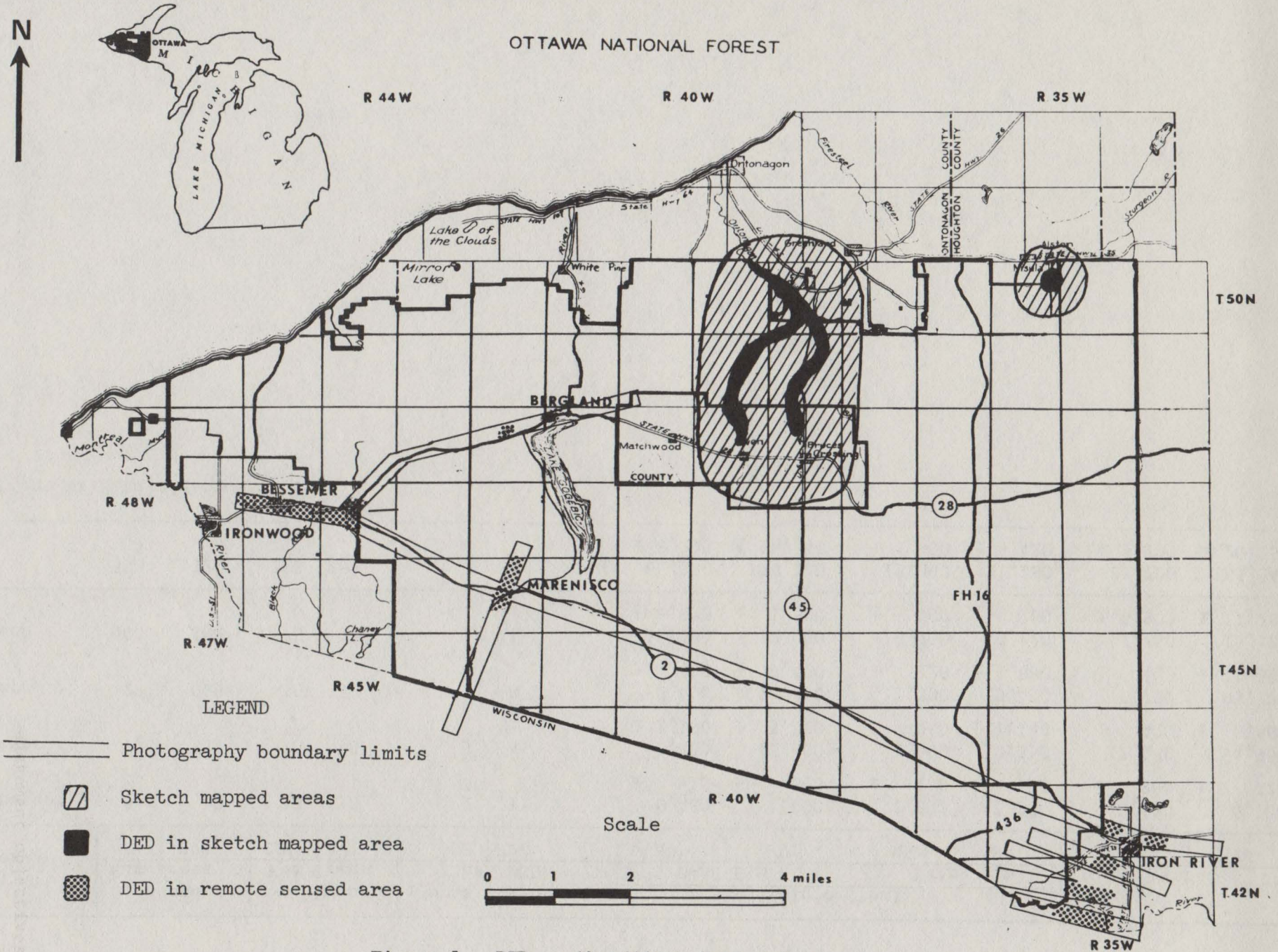

Figure 1. DED on the Ottawa National Forest.

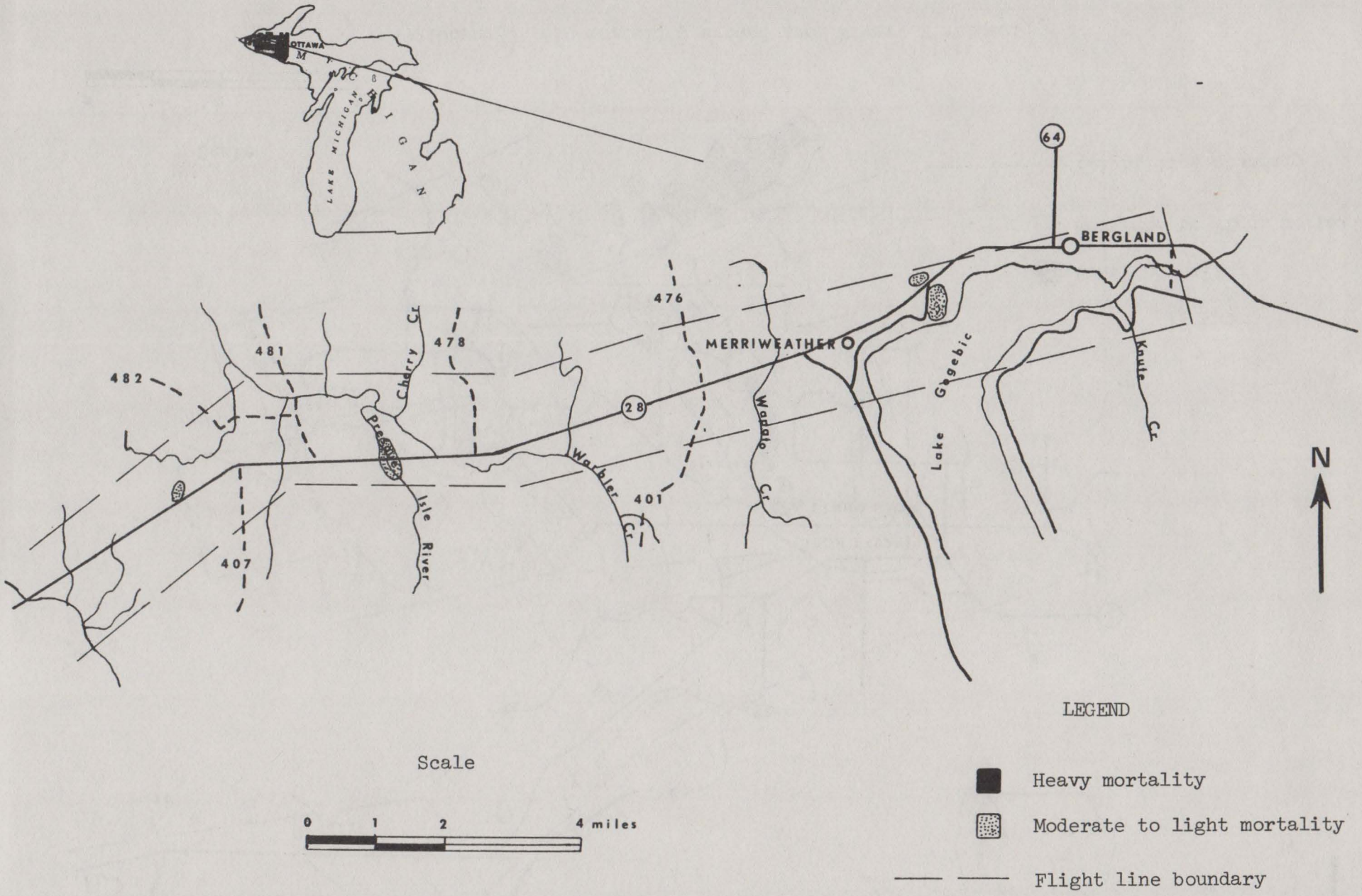

Figure 2. DED mortality around Merriweather, Michigan.

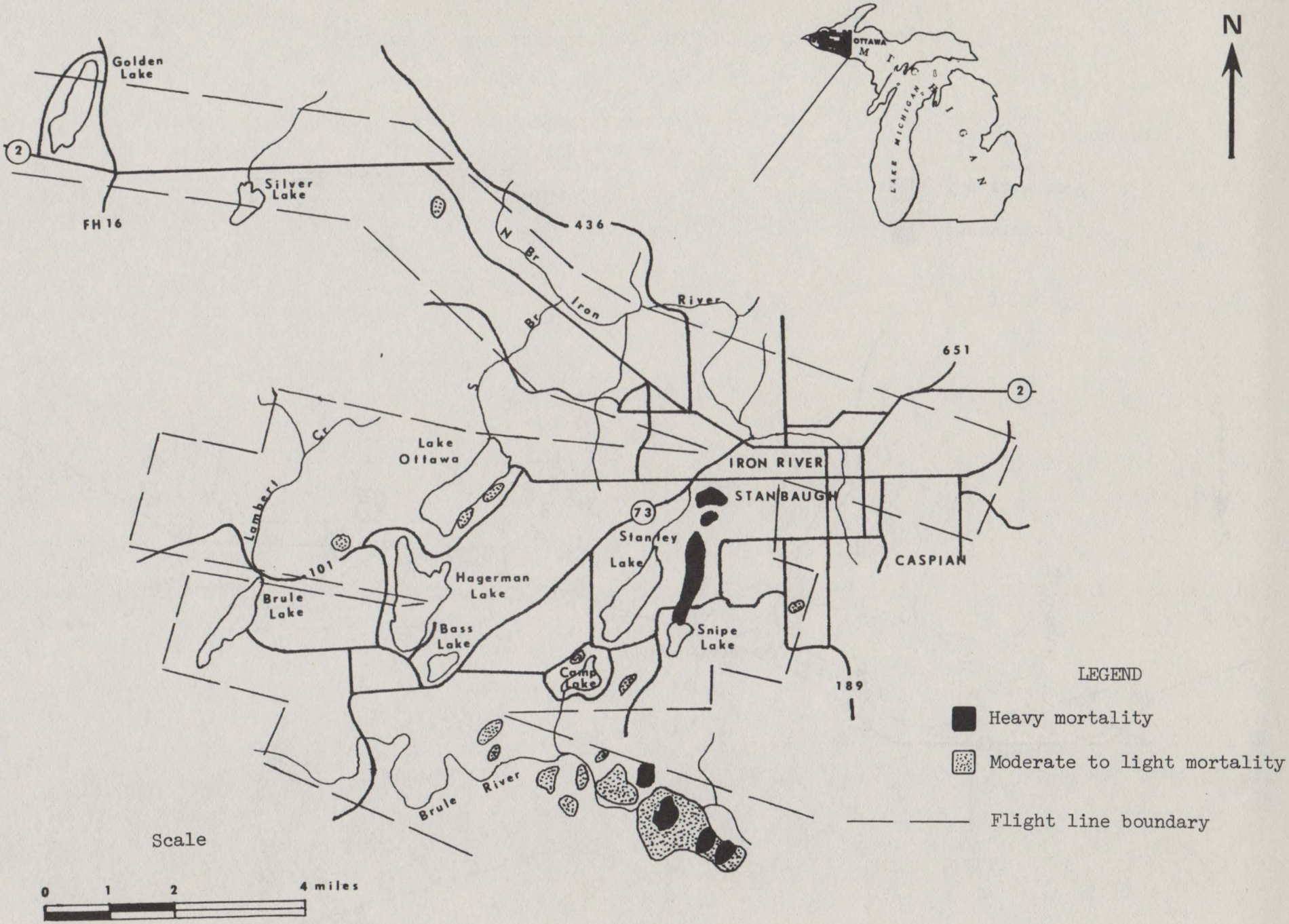

Figure 3. DED mortality around Iron River, Michigan.

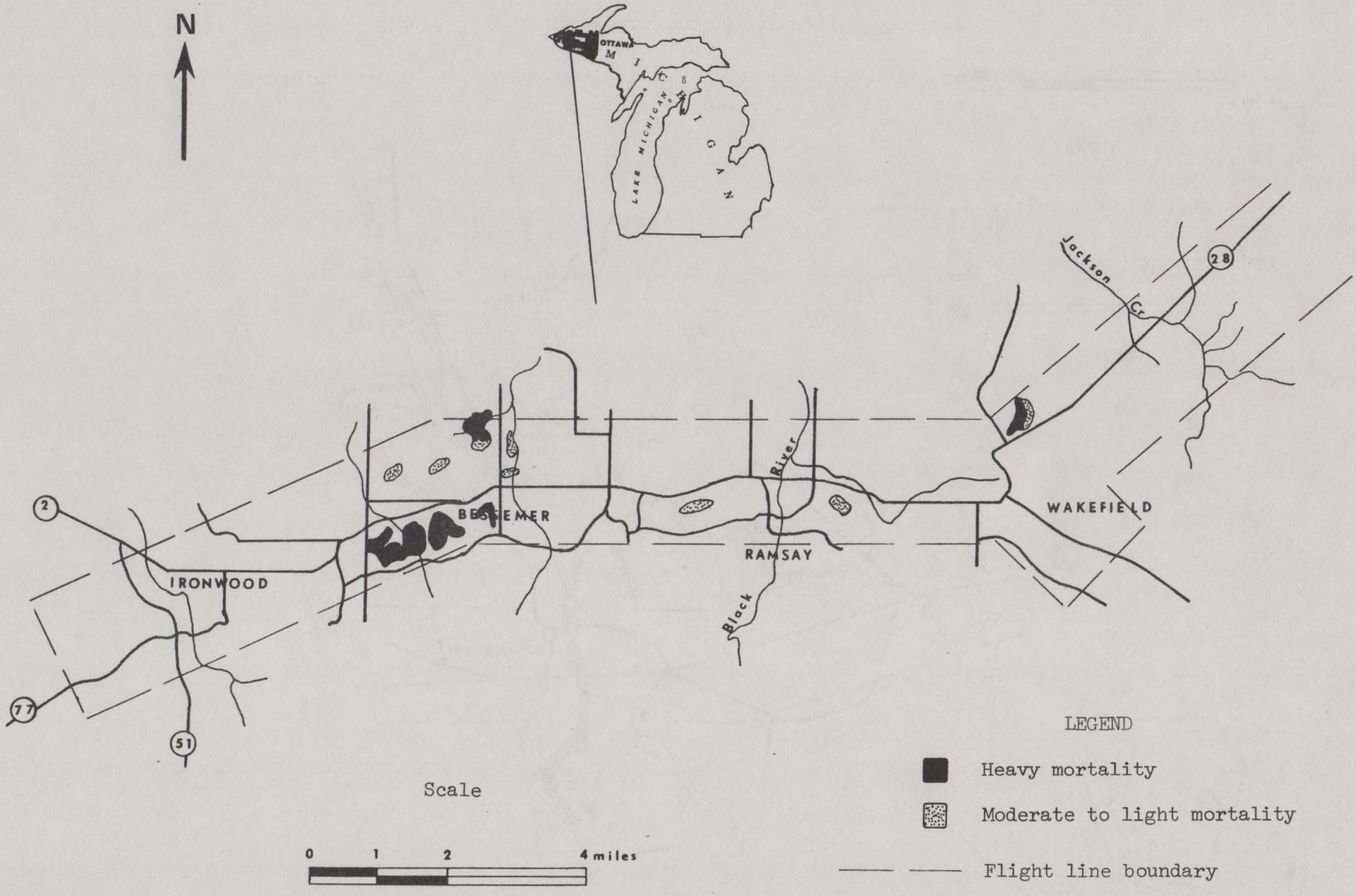

Figure 4. DED mortality around Bessemer, Michigan.

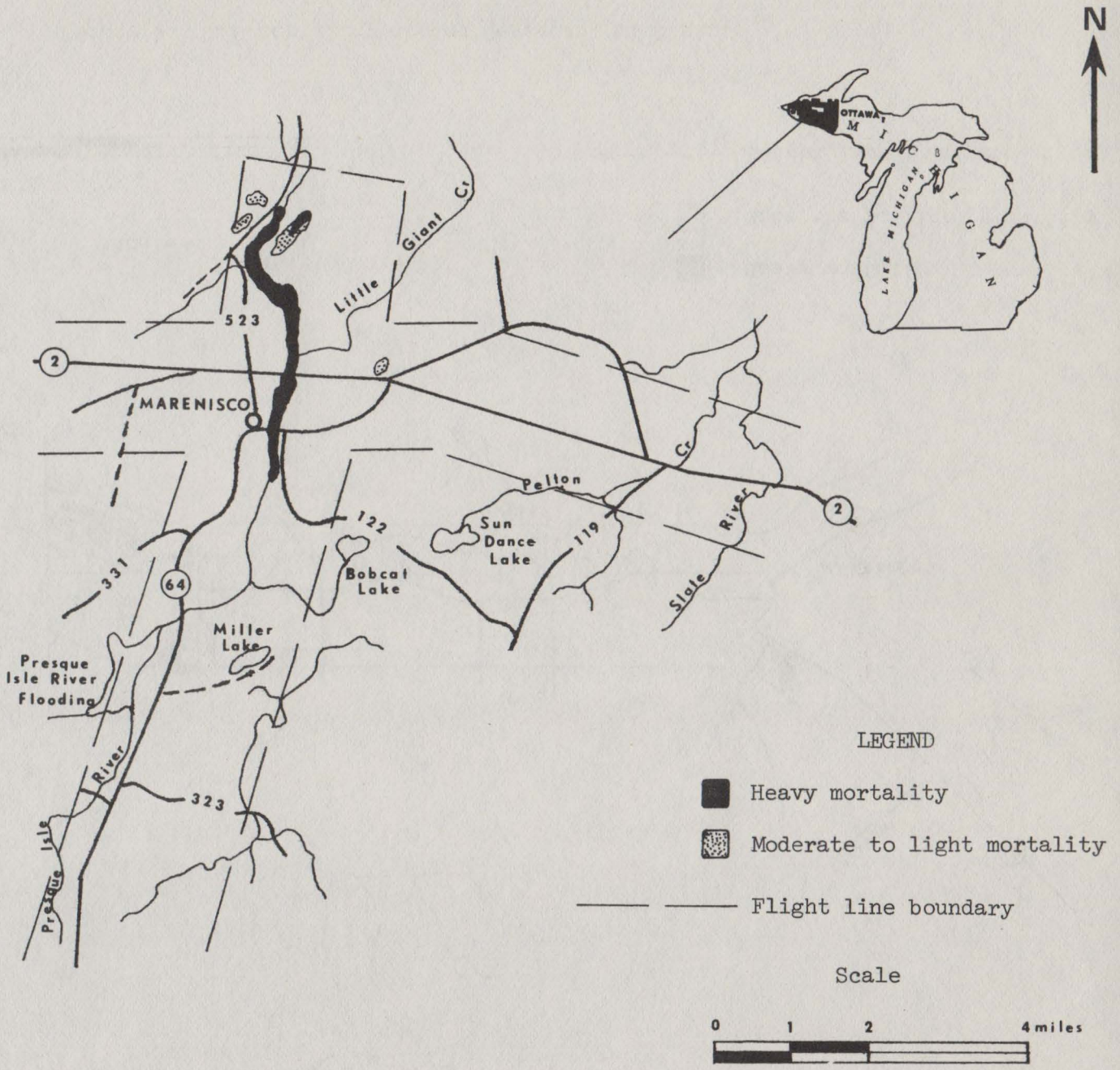

Figure 5. DED mortality around Marenisco, Michigan.